BERKELEY LAB

SCIENCE ON THE HILL

The Community Newsletter of Lawrence Berkeley National Laboratory Summer 2002

HOMELAND SECURITY

Hand-Held Radiation Detector Could Outsmart Terrorists

Long before September 11, engineers at Berkeley Lab and our sister labs in Livermore and Los Alamos began work on ways to prevent terrorists from smuggling radioactive material into the country. One solution is the Cryo3, a hand-held, battery-powered radiation detector weighing under 10 pounds.

"This offers extremely high-resolution radiation analysis in a portable package," says Lab engineer Lorenzo Fabris.

The Cryo-3 answers homeland security concerns about the possibile use of nuclear isotopes by terrorists to build both nuclear bombs and conventional bombs laden with radioactive material—so-called "dirty bombs" that can be hidden in backpacks and car trunks, making airports, border checkpoints, and shipping terminals the last best chance to thwart smuggling.

The hand-held Cryo3 detector, based on the radiation-sensitive element germanium, was developed to not only detect gamma rays, but also to determine their precise identity. That is, unlike a Geiger counter, the Cryo3 can actually identify the specific type of radioactive material, preventing a terrorist from masking plutonium in a seemingly benign package of medical isotopes such as barium.

Although still in prototype stage, ultimately Fabris foresees a time when next-generation models will safeguard the nation.

"Ideally, one day we will place a Cryo3 at all customs ports."

For more information, visit www.lbl.gov/Science-Articles/Archive/Eng-Cryo3-Krotz.html

TOOLS OF SCIENCE

Lab engineers worked with the Robotics Team from Oakland's Castlemont School to compete in the 11th Annual USFIRST Competition. The team built a robot that could pick up balls and transport them to the goal zone.

Building a Better Robot

In an exciting collaboration, members of the Lab's Engineering Division are advising the combined Robotics Team for Oakland's Castlemont High School and San Lorenzo's Arroyo High School. led by dedicated Castlemont teachers, the "Hybrids" recently competed in the 11th Annual US FIRST (For Inspiration and Recognition of Science and Technology) Robotics Competition, a nationwide event that teams professionals and young people together in order to solve an engineering design problem. Founded by inventor Dean Kamen, the program reaches more than 20,000 students who are eligible for $1.7million in scholarships.

Lab engineers traveled to Castlemont on Tuesdays and Saturdays for the team's working sessions where they designed a robot that would gather balls, put them into goals and then place the goals in their scoring zone, all in less than two minutes.

At the regionals, the Hybrids did not place high enough to advance to the championship event. However, the Lab's current collaboration is just the first of many steps in building a long-term, year-round effort to work with teachers to fund and develop a robotics curriculum.

Says teacher Erin Carlson, "Working with the Lab showed the students that there are many other ways to go, more options available to them than they were aware of before."

To keep up with the latest research and other science-related developments at Berkeley Lab, check out our online publication, Science Beat at enews.lbl.gov. Science Beat comes out every six weeks and allows the Lab scientists to communicate their research with the news media and the public at large. The current edition of Science Beat includes stories on advancements in DNA sequencing and nanotechnology.

Science Education

Hands-On Lessons in Information Technology

In January, the Lab's Information Technologies and Services Division (ITSD) welcomed five interns from Bay Area community colleges. These student interns work 20 paid hours per week as part of the occupational work experience opportunity for community college students. The program is a cooperative effort between the Lab and community colleges to create a structured, supervised and meaningful work experience related to the students' field of study while they also earn college credit. Now in its fourth year, the program has brought eight interns to the Lab, five of whom have continued to work here after their interships ended.

For more on the Lab's enducation outreach, go to csee.lbl.gov.

Community college student interns currently working at the Lab are (from left) Toby Logan, College of Alameda; Irina White, Mission College; Jonathan Dy, Diablo Valley College; and Wei Du-Griffiths and Art Pierce, College of Alameda.

Local Resident, Global Citizen

Hulk Sighting at Lab

Hollywood came to Berkeley Lab for four days in April to do location shooting for "The Hulk," a movie slated for release in the summer of 2003 and based upon the Marvel Comics figure and '70's TV series "The Incredible Hulk."

Some 200 cast and crew members spent April 19-22 camped out at the Lab, bringing with them lights and cameras, cabling and construction cranes.

The crew took roughly 80 hours to complete filming about eight scenes for a combined running time of only three minutes.

Most of the action took place in and around the Lab's Advanced Light Source, known for its distinctive copper dome. The spectacular cityscape and bay panoramas seen from Lab roads provided dramatic backdrops for the action, including a bike ride down the Hill by Bruce Banner (played by Aussie Eric Bana).

Other notables visiting the site included Director Ang Lee, who won a Best Foreign Film Oscar for *Crouching Tiger, Hidden Dragon*, and this year's Oscar winner for best supporting actress, Jennifer Connolly. Cast members Nick Nolte and Sam Elliott also made brief appearances at the Lab.

Friends of Science off to a Good Start

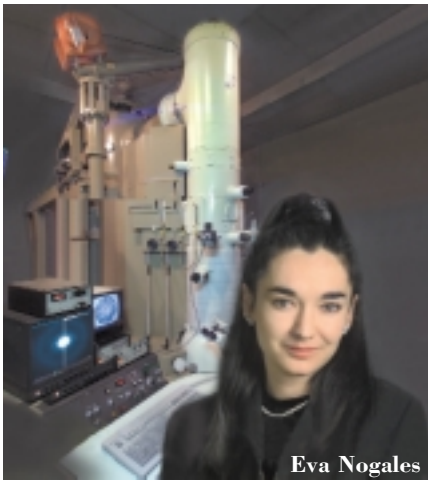
Friends of Science, a community outreach program to promote public understanding of the Lab's research, got off to a promising start on the evening of April 8 with a lecture by physicists Pier Oddone and Natalie Roe. Attendees received an introduction to the mystery of why nature favored matter over antimatter in the aftermath of the Big Bang, and what the B factory — the asymmetric collider of electrons and positrons— can contribute towards solving this mystery.

Said environmental planner Lois Rice, "It was a pleasure to listen to such a technical subject presented so well in layman's terms. I will eagerly attend future lectures in the series."

The second lecture on May 6 was given by Michael Siminovitch, the developer of the energy-efficient Berkeley Lamp. He discussed efficiency achievements in lighting technology at the Lab, such as that of the Berkeley Lamp, a table lamp system ideally suited to computer and office work environments while also providing a 30-40% reduction in energy use.

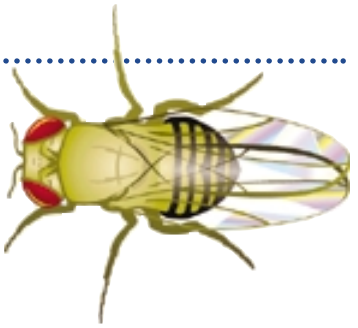
The June lecture was given by Eva Nogales of the Lab's Physical Biosciences Division and the UCB Department of Molecular and Cell Biology. She gave a presentation on the 20 year search to find the molecular structure of tubulin, the protein that is the foundation of a living cell's cytoskeleton and is used to treat some types of cancer. Nogales participated in the successful creation of the first 3-D molecular model of tubulin in 1998 here at the Lab.

To learn more about the Friends of Science program, visit our website at www.lbl.gov/friendsofscience.



Eva Nogales

Survival of the Fittest Molecules



Justin Fay, a geneticist in the Life Sciences Division, was part of a research team which showed that Darwin's evolutionary engine, the process of natural selection or "survival of the fittest," works as well at the molecular level as it does with living organisms. "We find strong evidence against the neutral theory of molecular evolution when we look at DNA variations across entire genomes," he says. "Rather than being driven by mutation and drift, molecular evolution is shaped by positive Darwinian selection." Earlier theories held that, at the level of DNA or amino acid sequences, change is relatively constant rather than being driven by the need to adapt to environmental pressures as Darwin showed is true for species of organisms. However, when Fay and his colleagues compared the genomes of different fruit fly species, they found a substantial amount of positive selection does take place at the molecular level. The next step for researchers is to determine the role mutations play in protein evolution. www.lbl.gov/Science-Articles/Archive/LSD-fittest-molecules-Fay.html

Lab geneticists examined data from 45 different gene surveys to compare the genomes in the common fruit fly, Drosophila melanogaster (above), to that of its close cousin, Drosophila simulans.

Solar-Cell Tech Turns to Plastic Power

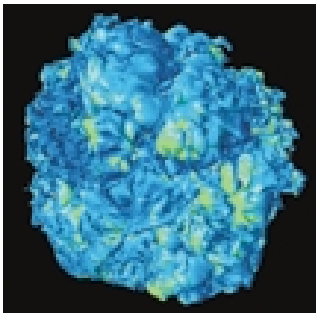
Researchers from the Lab and UC Berkeley have found new ways to make solar power cells out of plastic—creating electricity-generating materials you could print on a sheet of paper, stick onto your windows, have painted on your house, or even wear on your back. The latest stride toward producing bargain-priced electricity from the sun's energy came from the creation of a solar cell that spits out a tiny bit of electricity, but has the potential to be made far more powerful.

Led by Lab chemist Paul Alivisatos, the team relied on advances in nanotechnology—the ability to create or change materials at a minute level, atom by atom—to tweak molecules and thereby create electricity-carrying rods so tiny that more than 10,000 would be thinner than a human hair. Then a liquefied plastic semiconductor was added to create a solar cell that could be sprayed or painted onto almost any surface. The researchers believe their design could be beefed up for use in calculators or other small solar devices in two to five years, and might be powerful enough to generate household electricity in about 10 years at a cost as little as one-tenth of what a solar panel costs today. www.lbl.gov/Science-Articles/Archive/MSD-Alivisatos-solarcells.html

A panel of eight plastic solar cells based on inorganic nanorods and semiconducting polymers. The shiny ovals are the aluminum back electrodes of the individual solar cells.

Berkeley Lab & IBM Announce Science Grid Partnership

IBM Corp. and the Lab's National Energy Research Scientific Computing Center (NERSC) announced a collaboration to make one of the world's most powerful supercomputers available to researchers via the DOE Science Grid. The Science Grid will enable scientists at national laboratories and universities around the country to perform ever-greater calculations of increasingly larger datasets, as well as to explore the physical world through computational simulation and complex computer modeling.



"This should have a substantial productivity benefit for scientific R&D, and in some cases will open up entirely new avenues of exploration," said Horst Simon, director of the NERSC Division. Bill Kramer, manager of NERSC's computer operations, continues that "as DOE's flagship center for unclassified computing, making our resources more easily and more widely accessible via the Grid will enhance research across a broad spectrum of scientific disciplines."

NERSC operates a 3,328-processor IBM RS/6000 SP supercomputer, currently the third most powerful computer on Earth. For more information on the collaboration, visit www.lbl.gov/CS/Archive/headlines032202.html

This visual rendering of data output from a 3D supernova simulation is an example of the computational modeling made possible by supercomputing. The blue and green regions depict the turbulent environment beneath the supernova shock wave.

Did You Ever Wonder about the Science at Berkeley Lab?

On Saturday, Oct. 5, from 10:00 a.m. to 4:00 p.m. Berkeley Lab will once again open its site and scientific facilities to the public for its popular Open House event.

For the fourth time, the Lab is inviting the community to take part in a day-long series of tours, events and educational activities. At our last Open House, close to 5,000 visitors peered into the worlds of physics, life sciences, energy, computing and more. Open House 2002 will once again offer an opportunity for the community to learn about the Lab's many scientific programs, as well as to share in the excitement of the research being done here.

As in the past, there will be interactive demonstrations, displays of research facilities, numerous hands-on activities for children, as well as music and refreshments.

Visit out website at www.lbl.gov/OpenHouse for more information, and look to the next issue of "Science on the Hill" for a full schedule of Open House events.

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